

Amendments to the Specification:

Please replace the paragraphs, beginning at page 1, line 20, and ending on page 5, line 28, with the following rewritten paragraphs:

FIG. 4 illustrates the structure of a conventional alkaline storage battery. FIG. 4(a) is a longitudinal sectional view of a conventional alkaline storage battery as taken along a plane that passes the center of the positive terminal. FIG. 4(b) is a cross-sectional view as taken along the line B-B' in FIG. 4(a). In FIG. 4, belt-like positive plate 3 and belt-like negative plate 4 are sandwiched by belt-like separator 5 that interposes between them for electrical insulation and spirally wound. After winding, the outer surface is fixed with a polypropylene tape or with extended separator 5 thus forming electrode group 22 (as disclosed, for example, in Japanese Patent Laid-Open Application No. 2000-285956). Negative plate 4 of electrode group 22 is welded with a copper welding rod and joined to circular bottom metal current collector 7, being a current collector for the negative electrode, through protrusion 16 that projects out downward of negative plate 4. After housing in metal case 6 electrode group 22 that has been welded and joined to bottom metal current collector 7, bottom metal current collector 7 welded at protrusion 16 of negative plate 4 and the bottom of metal case 6 are electrically joined with a copper welding rod by inserting a copper welding rod into a hollow space left by removing a mandrel from electrode group 22 that has been wound. Subsequently, protrusion 15 of positive plate 3, one side edge along the longitudinal direction of which being projecting out upward, is joined to the bottom surface of circular upper metal current collector 18. Lead 11, being a current collecting-~~tub~~ tab, is welded to an upper part of upper metal current collector 18 of the positive electrode side, and a predetermined quantity of an alkaline electrolyte is poured through an upper opening of metal case 6. Subsequently, metal sealing plate 17 provided with cap-shaped positive terminal 13 is inserted through the upper opening of metal case 6, and lead 11, being a current collecting-~~tub~~ tab, and the lower surface of metal sealing plate 17 are joined. Lastly, the upper opening of metal case 6 and the periphery of metal sealing plate 17 are hermetically sealed through gasket 9 thus completing an alkaline storage battery.

However, in the above-described conventional structure of an alkaline storage battery, an extra space on the upper part of metal case 6 has been required as positive plate 3 and upper metal current collector 18, and negative plate 4 and bottom metal current collector 7, are to be respectively joined, and upper metal current collector 18 and metal sealing plate 17 provided with cap-shaped positive terminal 13 are to be joined to lead 11, being a relaying current collecting-~~tub~~ tab. Also, as lead 11, being a current collecting-~~tub~~ tab, is formed by folding a metal plate, an additional extra space has been needed. In other words, a space required for lead 11, being a relaying current collecting-~~tub~~ tab, is made available at the expense of the volume for the electrode group that can otherwise be utilized. This has been an obstacle against increase in the battery capacity and an issue to be solved.

Also, as the above-described conventional alkaline storage battery comprises upper metal current collector 18 to be joined to the upper side edge in the longitudinal direction of positive plate 3, and lead 11, being a relaying current collecting-~~tub~~ tab, that joins upper metal current collector 18 and the lower part of metal sealing plate 17, a certain number of components and related processes of joining them are inevitable thus leading to an increase in the manufacturing cost and in the number of manufacturing man-hours. Accordingly, attainment of a further higher capacity and price reduction of alkaline storage batteries has been an issue left to be solved.

SUMMARY OF THE INVENTION

The present invention addresses the above issues. It is an object of the present invention to provide a high-output and high-capacity alkaline storage battery by utilizing the space occupied by a lead, being a current collecting-~~tub~~ tab made of a metal, that has been required in a conventional alkaline storage battery for joining an upper metal current collector and the lower part of a metal sealing plate for increasing the volume of the electrode group that can be used for the battery and to provide a method for manufacturing an alkaline storage battery in which manufacturing cost and manufacturing man-hours are reduced by decreasing the number of components that have heretofore been required.

In order to achieve the above object, the alkaline storage battery of the present invention comprises a cylindrical metal case one end of which being circular and closed and the other end being open, a positive plate ~~one side edge along the longitudinal direction of which having a protrusion that projects out, a~~ negative plate one side edge along the longitudinal direction of which having one side edge along the longitudinal direction and having a protrusion that projects out, a negative plate having one side edge along the longitudinal direction and having a protrusion that projects out, an insulating separator, an upper metal current collector for collecting current for the positive electrode side and provided with a cap-shaped terminal, a bottom metal current collector for collecting current for the negative electrode side, and a metal sealing plate having a hole formed in the center. The alkaline storage battery is constructed in a manner such that an electrode group is formed by spirally winding the positive plate and the negative plate with the separator interposed between them and with the protrusions of the positive plate and the negative plate facing mutually opposite directions, the protrusion of the negative plate is joined to the bottom metal current collector, followed by housing the electrode group into the metal case, joining the bottom metal current collector and the bottom of the metal case, joining the protrusion of the positive plate to the bottom surface of the upper metal current collector, disposing the cap-shaped terminal of the upper metal current collector through the central hole of the metal sealing plate, joining the upper metal current collector and the metal sealing plate, pouring a predetermined quantity of an electrolyte from above the electrode group, and hermetically sealing the periphery of the sealing plate with a gasket at the upper opening of the metal case. Also, in a structure of the alkaline storage battery of the present invention, the positive plate contains a nickel compound and the negative plate contains a hydrogen absorbing alloy, and the electrolyte is an alkaline electrolyte. Also, in addition to a structure of the alkaline storage battery of the present invention in which a gas venting mechanism is provided in the metal current collector having a cap-shaped terminal, it also has a structure in which an elastic vent member is provided inside the terminal of the metal current collector having a terminal. The gas venting mechanism that the metal current collector having a cap-shaped terminal has is structured in a manner

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such that incisions are provided from the periphery toward the center in two to four directions and an elastic vent member is provided inside the terminal. Also, with the alkaline storage battery of the present invention, the metal sealing plate is annular in shape having a hole in the center with a size equal to or greater than the size of the cap-shaped terminal of the upper metal current collector in a manner such that the cap-shaped terminal of the upper metal current collector can pass through the hole to become a terminal for the positive electrode side. Also, in the structure of the alkaline storage battery of the present invention, asphalt is coated in the gap between the upper metal current collector and the annular metal sealing plate when joining the upper metal current collector and the metal sealing plate. Also, the alkaline storage battery of the present invention is so structured that the diameter of the cap-shaped terminal of the metal current collector having a cap-shaped terminal is in the range $1/5$ to $4/5$ of the outer diameter of the metal case.